DNV·GL

Certificate No:
**TAM00000NG**

# TYPE APPROVAL CERTIFICATE

## This is to certify:

**That the Hydraulic Rudder Actuator for Steering Gear**

with type designation(s)
**RV/IRV 3050-2, RV/IRV 4200-2**

Issued to
**Rolls-Royce Marine AS**
**BRATTVÅG, Norway**

is found to comply with
**DNV GL rules for classification – Ships**
**DNV GL rules for classification – High speed and light craft**

## Application :

**Can be used for all steering gears which according to current rules may be provided with single rudder actuator, including compliance with Appendix A.**
**IRV actuators may be used when duplicated actuator is required.**

**Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL.**

Issued at **Høvik** on **2018-02-01**
This Certificate is valid until **2022-06-30**.
DNV GL local station: **Ålesund**

Approval Engineer: **Svein-Olav Hannevik**

for **DNV GL**

**Oddvar Deinboll**
**Head of Section**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid.
The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.


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Job Id: **262.1-006848-7**
Certificate No: **TAM00000NG**

## Product description
Type of actuator: Hydraulic rotary vane

## Application/Limitation
The approval includes the rudder actuator and hydraulic system.

| RV 3050-2 | Non tanker | Tanker 10.000 grt – 100.000 tdw | Tanker > 100.000 tdw | Unit |
|---|---|---|---|---|
| Max design pressure | 100 | 100 | NA | bar |
| Max safety valve set | 100 | 100 | NA | bar |
| Max working pressure | 80 | 80 | NA | bar |
| Test pressure | 150 | 150 | NA | bar |
| Max design torque | 3780 | 3780 | NA | kNm |
| Max working torque | 3024 | 3024 | NA | kNm |
| Max rule rudder torque | 3024 | 3024 | NA | kNm |
| Max rudderstock Ø | 880 | 880 | NA | mm |
| Min rudderstock Ø [1)] | 520 | 520 | NA | mm |
| Max rudder angle | 2x 71,5 | 2x 71,5 | NA | deg |
| | | | | |
| | | | | |
| Max pump capacity [4)] | 2000 | 2000 | NA | l/min |
| Max radial force | 3000 | 3000 | NA | kN |
| Max axial force | 1800 | 1800 | NA | kN |

| IRV 3050-2 | Non tanker | Tanker 10.000 grt – 100.000 tdw | Tanker > 100.000 tdw | Unit |
|---|---|---|---|---|
| Max design pressure | 100 | 100 | 100 | bar |
| Max safety valve set | 100 | 100 | 100 | bar |
| Max working pressure | 80 | 80 | 80 | bar |
| Test pressure | 150 | 150 | 150 | bar |
| Max design torque | 3780 | 3780 | 3780 | kNm |
| Max working torque | 3024 | 3024 | 3024 | kNm |
| Max rule rudder torque | 3024 | 3024 | 3024 | kNm |
| Max rudderstock Ø | 880 | 880 | 880 | mm |
| Min rudderstock Ø [1)] | 520 | 520 | 520 | mm |
| Max rudder angle | 2x 71,5 | 2x 71,5 | 2x 71,5 | deg |
| | | | | |
| | | | | |
| Max Pump capacity [4)] | 1409 | 1409 | 1409 | l/min |
| Max radial force | 3000 | 3000 | 3000 | kN |
| Max axial force | 1800 | 1800 | 1800 | kN |

| RV 4200-2 | Non tanker | Tanker 10.000 grt – 100.000 tdw | Tanker > 100.000 tdw | Unit |
|---|---|---|---|---|
| Max design pressure | 106,25 | 106,25 | NA | bar |
| Max safety valve set | 106,25 | 106,25 | NA | bar |
| Max working pressure | 85 | 85 | NA | bar |

| | | | | |
|---|---|---|---|---|
| Test pressure | 160 | 160 | NA | bar |
| Max design torque | 5578 | 5578 | NA | kNm |
| Max working torque | 4463 | 4463 | NA | kNm |
| Max rule rudder torque | 4463 | 4463 | NA | kNm |
| Max rudderstock Ø | 880 | 880 | NA | mm |
| Min rudderstock Ø [1)] | 591 | 591 | NA | mm |
| Max rudder angle | 2x 71,5 | 2x 71,5 | NA | deg |
| | | | | |
| | | | | |
| Max pump capacity [4)] | 2000 | 2000 | NA | l/min |
| Max radial force | 3000 | 3000 | NA | kN |
| Max axial force | 1800 | 1800 | NA | kN |

| **IRV 4200-2** | | | | |
|---|---|---|---|---|
| Max design pressure | 100 | 100 | 100 | bar |
| Max safety valve set | 100 | 100 | 100 | bar |
| Max working pressure | 80 | 80 | 80 | bar |
| Test pressure | 150 | 150 | 150 | bar |
| Max design torque | 5578 | 5578 | 5578 | kNm |
| Max working torque | 4200 | 4200 | 4200 | kNm |
| Max rule rudder torque | 4200 | 4200 | 4200 | kNm |
| Max rudderstock Ø | 880 | 880 | 880 | mm |
| Min rudderstock Ø [1)] | 591 | 591 | 591 | mm |
| Max rudder angle | 2x 71,5 | 2x 71,5 | 2x 71,5 | deg |
| | | | | |
| | | | | |
| Max pump capacity [4)] | 1409 | 1409 | 1409 | l/min |
| Max radial force | 3000 | 3000 | 3000 | kN |
| Max axial force | 1800 | 1800 | 1800 | kN |

1. Based on yield strength in rudder stock equal to 235 N/mm$^2$and rudder stock deflection due to bending moment i.w.o. the upper bearing less than twice the diametrical bearing clearance. (Pt.4 Ch.10 Sec.1 [2.11.20]) However, minimum rudderstock diameter will normally be limited by requirement with respect to fitting of steering-gear to rudderstock (not included in type approval).
2. For non-duplicated rudder actuators for oil, chemical and liquefied gas carriers of 10 000 gross tonnage and upwards, but less than 100 000 tdw (Pt.4 Ch.10 Appendix A), Magnetic particle testing (MT) is required for all machined surfaces.
3. Provided that tangential shrink fitting stress at the outer hub surface is less than 120 N/mm$^2$ (Pt.4 Ch.10 Sec.1 [2.11.16]). Otherwise vane stress must be specially considered (i.e. case by case approval).
4. Stated value is per pump. Changes in pump capacities may lead to required change in relief valve capacity (see Pt.4 Ch.10 Sec.1 [2.10.6]). Valve characteristics shall then be submitted.

## Type Approval documentation

| Drawing No. | Rev. | Title |
|---|---|---|

## Marking of product
The product shall be marked with manufacturer's name or trademark and type number identification.

## Periodical assessment
For retention of the Type Approval, a DNV GL surveyor shall perform an assessment after 2 years and after 3.5 years to verify that the conditions of the type approval are complied with. A renewal assessment will be performed at renewal of the certificate.

In cases where the Type Approved product is manufactured at other companies, the Periodical Assessment shall verify that the Type Approval applicant has a quality control system for consistent production at their licensees/subcontractors. Furthermore Periodical Assessment shall be carried out randomly at these companies.

## Other conditions
A steering test is to be carried out under normal working conditions to demonstrate compliance with requirements in Pt.4 Ch.10 Sec.1 [9].

For approval of the complete steering gear the following shall be submitted case-by-case:
- Technical data sheet
- Pump capacity and relief valve capacity
- Hydraulic diagram with list of alarms and set points
- Arrangement drawing of steering gear
- Calculation of connection to rudderstock
- Mounting and operation instructions to follow each delivery

- Operation instructions for all operation modes including local control (Yard supply)
- Foundation and mounting arrangement, including bolting and chocking calculations (Yard supply)
- Arrangement of steering gear compartment (Yard supply)

Deflections of rudderstock due to rudder force may have the following consequences - which need to be considered:
- Deflections exceeding bearing clearances will induce an additional bending moment in rudderstock (Pt.4 Ch.10 Sec.1 [2.11.21])
- Increased bearing loads and friction losses
- Increased pressure in the connection between rudderstock and rotor

END OF CERTIFICATE